

REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

As correctly noted in the Office Action Summary, claims 1-3 and 5-10 were pending with claims 8 and 9 withdrawn from consideration. By the present response, claim 10 has been amended and claims 8 and 9 canceled. Thus, upon entry of the present response, claims 1-3, 5-7 and 10 remain pending and await further consideration on the merits.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims and the specification, page 4, lines 13-14.

Entry of the foregoing is appropriate pursuant to 37 C.F.R. §1.116 for at least the following reasons. First, the amendments address the new objections to the drawings and claim 10, thereby reducing the number of issues present upon appeal. Second, the amendments raise no new issues that would necessitate further search and/or substantive reexamination.

DRAWINGS

New FIG. 2C has been added consistent with the description of a conically shaped tube at page 4, lines 13-14. No new matter has been added. Withdrawal of the objection is respectfully requested.

CLAIM OBJECTIONS

Claim 10 is objected to because of informalities. Claim 10 has been amended to address the objection by correcting a typographical error. Thus, reconsideration and withdrawal of the objection is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 1-3, 5-7 and 10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,016,460 to England et al. (hereafter "*England et al.*") in view of U.S. Patent No. 5,126,107 to Darnfors (hereafter "*Darnfors*") on the grounds set forth in paragraph 6 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The present disclosure is directed to a metal tube for use in furnaces having improved resistance towards the environment in furnaces for cracking of hydrocarbons. Claim 1 recites that a metal tube comprises, *inter alia*, a body, a smooth outer surface and an inner surface with a profile, wherein the body is made of a stainless iron-nickel-chromium base alloy comprising, in weight %, max 0.08% C, 23-27% Cr, 33-37% Ni, 1.3-1.8% Mn, 1.2-2% Si, 0.08-0.25% N, 0.01-0.15% rare earth metals, balance Fe; and normal impurities; the profile comprises a plurality of valleys or recesses, said valleys or recesses extending longitudinally along the tube and are smoothly curved; and a chromium oxide layer on the inner surface.

The rejection based on the disclosures in *England et al.* in view of *Darnfors* is improper and should be withdrawn because a *prima facie* case of obviousness has not been established. Specifically, the disclosure in the two cited references includes details on the alloy composition which teach away from the proposed

combination. Therefore, there is no suggestion or motivation within the references for the proposed modification or combination and the rejection is improper. See MPEP §2142-2143.

England et al. discloses an oversized, internally finned tube 24 formed with a mandrel 10. Oversized tube 24 has fins 26 and radially overspaced depressions 28. Figure 5 depicts the oversized diameter pipe. *England et al.* discloses that the oversized internally finned tube was formed of INCOLOY® alloy 800HT® having a composition as disclosed at column 2, lines 65 et seq. *England et al.* also discloses that other alloys that may be suitable for use with the invention are those "difficult to work alloys" such as alloys with greater than 30 wt % nickel and 10 wt % chromium. See column 5, lines 11-14. Further and importantly for the discussion here, *England et al.* discloses that suitable alloys have a composition that includes 0.0 to 1.0 Si (see page 2, line 68, page 5, line 22 and claim 1).

As noted by the Examiner and based on at least this difference, "*England et al.* do not disclose the specific elemental compositions of the metal alloy tube." The Examiner then relies on the disclosure in *Damfors* for the alloy composition.

Damfors discloses an iron, nickel, chromium base alloy having an austenitic structure. The composition of the alloy is provided at Table 1 in column 2. In addition to Table 1, *Damfors* discloses in col. 2, lines 41-44 that "Silicon is required in an amount of at least 1.2% in order that a combination effect between silicon and the rare earth metals shall be achieved with reference to the oxidization resistance."

Thus, one of ordinary skill in the art considering the disclosure in *England et al.* and *Damfors* would not have been motivated to combine the two disclosures in the manner suggested. Specifically, because the composition in *England et al.*,

which is important to his disclosure, is that of a "difficult to work alloy" such as alloys with, *inter alia*, a composition that includes 0.0 to 1.0 Si and alloys disclosed by *Darnfors* are required to have an amount of at least 1.2% Si; then alloys disclosed in *Darnfors* have a composition outside that of suitable alloys for inclusion in *England et al.* Further, the alloys in *England et al.*, and by extension the processing of such alloys, are not suitable for inclusion in *Darnfors* because they do not have the requisite levels of Si.

Furthermore, the disclosures in these two references teach away from the proposed combination because the maximum disclosed Si level of suitable alloys in *England et al.* is below the minimum level of Si disclosed as required in the alloys in *Darnfors*.

From the above, it is respectfully asserted that a *prima facie* case of obviousness has not been established by the Official Action. Because the disclosures relied upon in the rejection teach away from the proposed modification, there is no suggestion or motivation within the references for the proposed modification or combination and the rejection is improper. See MPEP §§2142-2143.

Applicants remaining claims each depend directly or indirectly from independent claim 1. The rejection of these claims should be withdrawn for at least the same reasons as noted above.

Claims 1, 2 and 5-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,206,880 to Olsson (hereafter "*Olsson*") in view of U.S. Patent No. 4,478,275 to Ernst (hereafter "*Ernst*"), and further in view of

Damfors on the grounds set forth in paragraph 7 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The rejection based on the disclosures in *Olsson* in view of *Ernst* and further in view of *Damfors* is improper and should be withdrawn because a *prima facie* case of obviousness has not been established. Specifically, the disclosure in the cited references includes details on the alloy composition which teach away from the proposed combination. Therefore, there is no suggestion or motivation within the references for the proposed modification or combination and the rejection is improper. See MPEP §2142-2143.

Olsson discloses a tube for a furnace for cracking hydrocarbons (see col. 1, lines 6-7). The tube has an internal profile as illustrated in FIG. 2 and is formed of an alloy having a composition including Cr. 15-30 wt.%, Al 3-10 wt.%, one or more of Y, Zr, Ti, Hf, Ce and Ca up to 1 wt.% and balance Fe. The tubes are coated on the inside by an Al oxide layer (col. 2, lines 5-6). The addition of up to 1 wt.% of one or more of Y, Zr, Ti, Hf, Ce and Ca "have been found to improve the properties of the aluminum oxide layer" (col. 2, lines 44-45).

Ernst discloses a heat pipe for fluidized bed combustors having two distinct coatings spray coated onto a surface (Abstract). The first of the two layers is a mixture of iron, chromium, aluminum, and yttrium or titanium. The major constituent is iron and the other materials are used in the following ranges of percentages of weights of the total mixture: chromium 20 to 30%; aluminum 2 to 10%; and yttrium or titanium 0.1 to 2% and balance iron (col. 3, lines 44-47). The chromium forms into chromium oxide (col. 2, line 22). The second coating consists essentially of

commercially available stabilized oxides selected from the group consisting of aluminum, zirconium and yttrium (col. 2, lines 37-43).

The base material in *Ernst* of which the casing is constructed must contain at least one-tenth percent of aluminum and at least one-tenth percent of either silicon, titanium, yttrium or yttrium oxide or some mixture of these materials. These minor constituents aid in the bond between the base metal and the first layer sprayed onto the casing (col. 1, line 66 – col. 2, line 4). An example of a suitable base material is Incoloy 800, having a composition that includes nickel, 30-35%; chromium, 19-23%; carbon, 0.1% max.; manganese, 1.5% max.; aluminum, 0.15-0.6%; titanium 0.15-0.6%; and silicon 1.0% max. The balance of the material is iron. It is the last three minor constituents, aluminum, titanium and silicon, “which are important to the later coating operations because of their bond with the coatings” (col. 3, lines 21-28).

As noted by the Examiner, *Olsson* (in view of *Ernst*) does not disclose the specific elemental compositions of the metal alloy tube (see page 6 of the Official Action) The Examiner then relies on the disclosure in *Darnfors* for the alloy composition.

However, *Darnfors* discloses an iron, nickel, chromium base alloy having an austenitic structure. The composition of the alloy is provided at Table 1 in column 2. In addition to Table 1, *Darnfors* discloses in col. 2, lines 41-44 that “Silicon is required in an amount of at least 1.2% in order that a combination effect between silicon and the rare earth metals shall be achieved with reference to the oxidization resistance.”

Thus, one of ordinary skill in the art considering the disclosure in *Olsson* (in view of *Ernst*) and *Darnfors* would not have been motivated to combine the

disclosures in the manner suggested. Specifically, the composition in *Ernst* has a maximum of 1.0 wt.% Si in the base material and the content of Si in the base material is important to the coating operation because of bonding. However, the alloys disclosed by *Darnfors* are required to have an amount of at least 1.2% Si. In other words, the alloys disclosed in *Darnfors* have a composition outside that of suitable alloys for base materials onto which the coatings in *Ernst* are to be applied. Therefore, the disclosures in these references teach away from the proposed combination because the alloy composition of *Darnfors* includes a minimum Si level above the maximum level of Si disclosed in the pipe alloy to be coated by the coatings of *Ernst*, including the Cr oxide coating.

From the above, it is respectfully asserted that a *prima facie* case of obviousness has not been established by the Official Action. Because the disclosures relied upon in the rejection teach away from the proposed modification, there is no suggestion or motivation within the references for the proposed modification or combination and the rejection is improper. See MPEP §§2142-2143.

Applicants remaining claims each depend directly or indirectly from independent claim 1. The rejection of these claims should be withdrawn for at least the same reasons as noted above.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

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AMENDMENTS TO THE DRAWINGS:

Attached hereto is a replacement drawing sheet. FIG. 2C has been added in agreement with page 4, lines 13, 14 of the specification. This figure is also consistent with the specification amendments contained in this paper. Since this is a new figure on a new drawing sheet, there is no annotated drawing sheet.